Suiform Soundings

PPHSG Newsletter

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Contents:

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is the newsletter of the IUCN/SSC Pigs, Peccaries, and Hippos Specialist Group (PPHSG). The newsletter is sponsored by the Center for International Forestry Research (CIFOR), Bogor, Indonesia.

CIFOR

Photo front page: Red River Hogs (*Potamochoerus porcus*) and Bongo (*Boocerus eurycerus isaaci*) at the Los Angeles Zoo. Photo by Tad Motoyama

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Editorial:

Here it is, the first PPHSG newsletter under its new name 'Suiform Soundings'. We finally settled on this name, although we realize that not everyone was too happy with it. Admittedly, 'suiform' as the connection between the hippos and the suiformes will be lost on most non-specialists. Still, it as a catchy name that accurately represents all the taxa covered by the newsletter. The newsletter will be closely associated with the PPHSG website and thus the link to pigs, peccaries, and hippos is more easily made.

I am very happy with the large number of high quality contributions to the present issue. By the beginning of May I was getting rather nervous having received only 1 paper, and it looked like issue 4(1) was going to have a maximum of 15 pages. A few emails marked 'urgent' later, and additional contributions started to come in one after the other. It meant much last-minute editing work by me, and I would certainly prefer a more evenly spread paper submission, but then again, the result is good, and in the end that's all that counts.

Thanks very much for all your help and input.

Erik Meijaard, Cairns

Revising the Action Plan — but making small headway with the next PPHSG Group meeting

William Oliver, Manila. Email: WLROliver@aol.com

The PPHSG Action Plan: '*Pigs, Peccaries and Hippos – Status Survey & Conservation Action Plan*' was published by IUCN in December 1993, and formally launched early the following year during the 3rd International Symposium on the Wild Boar and other Suiformes in Turin. Its appearance marked an important collaborative effort between the (then) IUCN/SSC 'Pigs & Peccaries' and the 'Hippo' Specialist Groups (since merged at the SSC's behest) and a hugely important and influential contribution to anyone's understanding of the taxonomy, biology and conservation requirements of these animals. Thanks to major reviews by Colin Groves and Peter Grubb it also signalled the recognition of much higher levels of species' diversity than had been generally accepted theretofore; e.g. five (not three) African endemic pigs and at least seven (not five) species of *Sus* in Asia. It also did what it was supposed to do in terms of synthesising and rationalising an enormous body of disparate information into a clear and coherent set of future research and conservation management priorities for each species and for each of the three regions of greatest interest and concern, namely the neotropics, sub-Saharan Africa and south & south-east Asia; duly seasoned with similar reviews of some key topics – the peccary hide trade, the feral pig problem and the cultural and economic importance of these animals in many surviving human societies.

As a result, the Action Plan remains the benchmark reference for anyone interested in these animals. Unfortunately, it is also seriously out-of-date in many places. A great deal has happened over the past ten years – much of it good (our own efforts having contributed greatly to most of the major advances in this process), but much more that was not good. Thus, whilst important progress has been made in the implementation of highest priority recommendations for some the most threatened species (e.g. pygmy hogs, Visayan warty pigs and Chacoan peccaries), the decade has also been marked by dramatic declines in the numbers of various other species (e.g. Javan warty pig, mainland babirusa and 'common' hippo). Other notable developments include: the discovery of an entirely new species, the Sulu warty pig (*Sus* sp. nov.); some tantalisingly evidence for the continued survival of the (ever elusive) Indo-Chinese warty pig (*S. bucculentus*); the proposed separation of several, previously recognised, subspecies as full species (i.e. the Banded pig, *S. vitattus*; the

Palawan bearded pig, *S. ahoenobarbus*; and the Togian and Sula babirusas, *Babyrousa togeanensis* and *B. babyrussa*, respectively). Needless to say, all of these, and diverse other, developments will profoundly influence our understanding of the distribution, overall conservation status and likely future management needs of these animals.

Meanwhile, the SSC has confirmed that it would be interested in publishing a new Action Plan, providing it was a substantively different work, rather than merely an updated (second) edition of the original Plan. In fact, a major revision would seem both necessary and assured given these new taxa, the substantive progress made in some areas with some taxa and the substantive reductions in the ranges and numbers of various other taxa – whether for reasons of taxonomic revision or severe, human-induced attritions. Likewise, an enormous amount of important new information has been generated through recent research in Central and South America, Africa and South-east Asia; whilst on-going mtDNA studies are likely to clarify and alter our understanding of the diversity and systematic (especially phylogenetic) relationships of these animals – again with important implications for the identification of future conservation research and management priorities.

To these ends, it has been repeatedly suggested that we should convene a formal meeting of the Group as soon as possible. Unfortunately, whilst everyone agrees on the desirability of this, we have yet to resolve the inherent problems relating to venue, and more particularly, costs. By the very nature of such a meeting it is essential that all Group officers and others most closely involved with the implementation of priority research and management interventions are able to attend. To these ends, a number of different venues have been suggested by various members, but follow-up circulars intended to assess interest amongst the wider body of members and affiliated researchers have elicited poor response rates. Moreover, the majority of those who have bothered to respond have either indicated their inability to attend owing to conflicts in schedules and/or their need for financial assistance to attend. Whilst the low rate of response is obviously disappointing and discouraging (especially to those few members who have not only confirmed their interest in attending, but willingness to cover their own costs), the financial constraints are both understandable and real - especially re. members travelling from less-developed countries and/or those who receive little or no institutional support to attend international meetings. Needless to say, most of the venues suggested thus far have been linked to larger conferences in Europe or the US, though attendance by the larger majority of members is likely to prove cost-prohibitive without additional financial support wherever such meetings are convened. So far, we've had three well-attended meetings - two of which were subsidised though assistance previously (but sadly no longer) available from the SSC, Durrell Wildlife Conservation Trust and British Airways' Assisting Nature Conservation Programme; whilst the other was wholly sponsored by Zoo Berlin. Accordingly, if anyone knows anyone able and willing to sponsor a fourth meeting that would be both truly worthwhile and representative please let me know; though I'd also be more than happy if anyone else would be interested in taking on the (somewhat thankless) task of convening a meeting in which there is a fair chance that everyone who needs to be there will attend. In the interim, however, I would also like to urge all relevant members to arrange smaller meetings on an opportunistic or *ad hoc* basis (as per the annual meetings convened by the Peccary/ Neotropical Subgroup, and AZA & EAZA Wild Pig and Peccary Advisory Groups), whether to discuss regionally-based (e.g. Sub-Saharan Africa and South/South-east Asia) or topically-based (e.g. threatened species' recovery, human-utilisation, systematics) issues.

For these reasons, we also propose to proceed with the preparation of the new Action Plan by electronic means. To these ends, all group members will be contacted by e-mail during the next few weeks with a view to agreeing format, contents and individual responsibilities for the preparation of relevant sections.

Papers and communications

Certification of the peccary pelt trade: A strategy for managing bush meat hunting in the Peruvian Amazon

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Introduction

Bush meat hunting is currently one of the greatest conservation issues of tropical forests. Bush meat hunting is commonplace throughout the Neotropics and rural people hunt tropical forest mammals for subsistence food and to sell meat and hides in urban markets. Conservation solutions to bush meat hunting should be based on finding management solutions that convert unsustainable hunting to more sustainable hunting. In this paper we report on certification of the peccary pelt trade as a mechanism to set up wildlife management of bush meat hunting in the Peruvian Amazon.

The collared peccary (*Tayassu tajacu*) and white-lipped peccary (*Tayassu pecari*) are important resources for subsistence hunters of the Peruvian Amazon. In Peru, subsistence hunting of peccaries is legally defined as the use of peccary meat for household consumption or the sale of peccary meat in settlements of fewer than 3,000 inhabitants. Rural inhabitants hunt peccaries mainly for their meat, which has an economic value of approximately $23 for a collared peccary and $30 for a white-lipped peccary either as subsistence food or local sale (Bodmer et al. 2004b). Peccary pelts are sold as a by-product and have an economic value to hunters of approximately $5 for a collared peccary pelt and $3 for a white-lipped peccary pelt (Bodmer and Pezo 2001, Llellish 2002, Fang 2003). Approximately 51,419 collared peccary pelts and 20,522 white-lipped peccary pelts are legally exported every year from Peru under a quota system imposed by the Peruvian government (INRENA 2004). The pelts are tanned in Peru and sold to the European leather industry for the manufacture of high quality gloves and shoes (Figures

Figure 1. Peccary pelts are sold as sub-products and are used in the manufacture of fine peccary products.

1A. Raw peccary pelt

1B. Crust skin (tanned, semi-processed skin)

1C. Fine peccary gloves

1A-C).

Collared and white-lipped peccaries range throughout much of central and south America. Peccary pelts were exported from many central and south American countries during the first half of the 20th century prior to the implementation of CITES in 1973. During the 1960's and 70's many countries began to prohibit the export of peccary pelts and in 1986 collared and white-lipped peccaries were placed on Appendix II of CITES. Peru is currently the only range state that permits legal export of peccary pelts and pelts can only be exported if they originate from subsistence hunters living in the Amazonian region.

Certification of peccary pelts in Peru might be a mechanism to stimulate local communities to set up wildlife management programmes and would work as follows. Communities that manage their wildlife species sustainably would be certified, and in turn, would get added benefits directly through an increased value of pelts and indirectly through recognition of their conservation activities. This added value would act as an incentive for communities to convert unsustainable hunting practices to more sustainable hunting. Thus, the leather certification programme would bring economic benefits to rural families, improving their living standards, and at the same time help to conserve wildlife. The added value would not increase hunting pressure, but would guarantee that hunting is sustainable, since any unsustainable increase in hunting would deem a community unfit for certification (Bodmer et al. 2004a).

Preconditions for implementing a certification programme of the peccary pelt trade are 1) that peccaries can be hunted sustainably and 2) that community-based wildlife conservation is a successful way of setting up wildlife management. Studies in the Peruvian Amazon have shown that both of these preconditions can be met. Both collared and white-lipped peccaries appear to be sustainably hunted in numerous localities throughout the Peruvian Amazon (Bodmer 1994, Alvard 1998, Bodmer et al. 1997a, Aquino et al. 2001, Llellish et al. 2001, Bodmer et al. 2003). Peccaries are usually among the species that show little or no signs of overhunting. In addition, studies have shown that community-based conservation is a viable means of setting up long-term wildlife management in the Peruvian Amazon (Bodmer et al. 1997b, Bodmer and Puertas 2000, Newing and Bodmer 2004). Rural communities realise the importance of wildlife

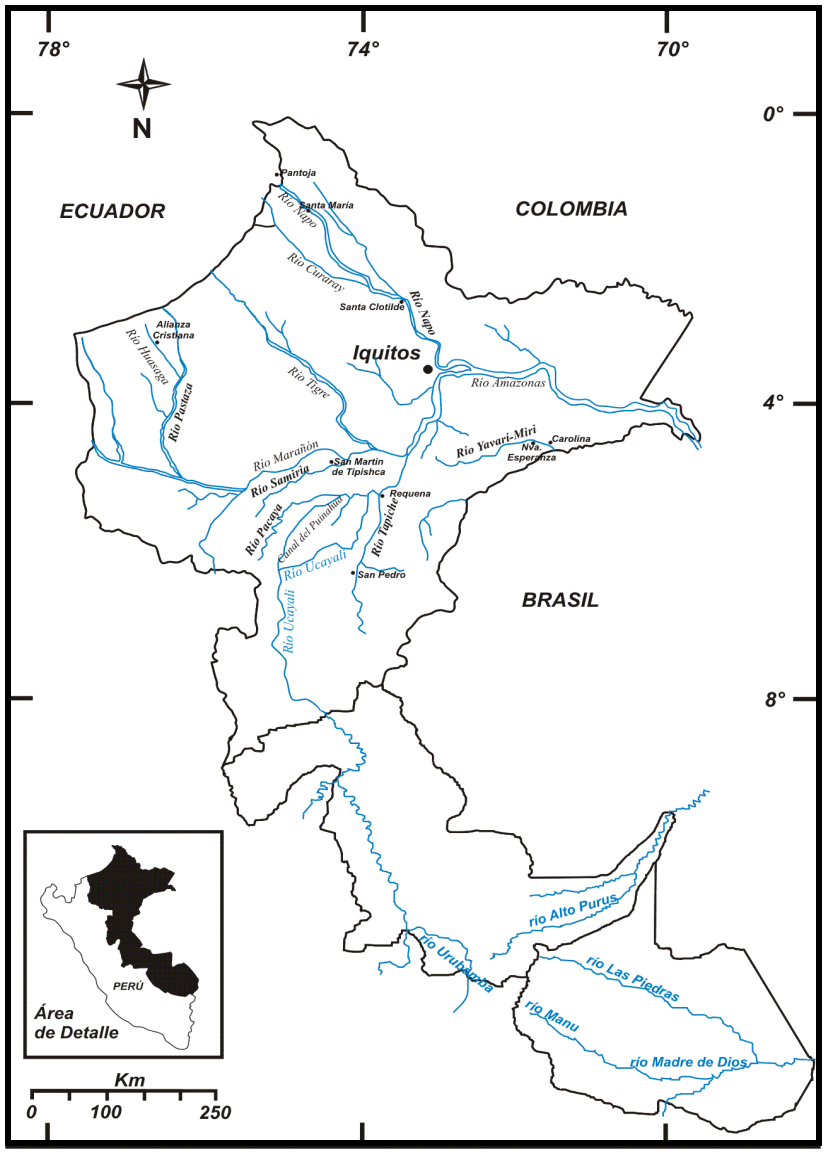

Figure 2. Map of the Peruvian Amazon showing the region where the certification of the peccary pelt trade would be set up.

for subsistence food and monetary income, and are generally interested in managing their wildlife for long-term sustainable use (Bodmer et al. 1997b, Bodmer et al 2004b). If a rural community manages its wildlife sustainably, it will not only conserve species populations, but also the entire rainforest habitat with all of its ecosystem functions.

Implementing a certification programme for peccary pelts in the Peruvian Amazon will require participation of the major stakeholders (Figure 3). Currently, the chain of actors in the peccary pelt trade includes direct stakeholders at the national and international level, and indirect stakeholders. At the national level there are four direct stakeholders involved with commercialising peccary pelt trade: rural hunters who harvest peccaries and who are the point of first sale; minor middlemen who collect peccary pelts from rural communities; major middlemen who collect peccary pelts in urban centres; and national tanneries who tan and export skins. At the international level there are three stakeholders: international tanneries who import and finish skins; leather manufactures who produce final products; and European leather shops who sell fine leather articles (Figure 3).

There are also indirect stakeholders currently involved with the peccary pelt trade, including the national management authority, National Institute of Natural Resources – Peru (INRENA) who sets harvest and export quotas; CITES who oversees the export: and conservation and research groups such as the IUCN Pigs, Peccaries and Hippos Specialist Group, the Wildlife Conservation Society, and the EU Peccary Project (PECARI).

Certification of peccary pelts will have to meet criteria and standards for "green" labelling. This will require 1) hunting of peccary populations will need to be sustainable, 2) voluntary participation of rural communities within a community-based management system, and 3) voluntary participation of other stakeholders such as middlemen and national tanneries. A peccary pelt certification programme will also require the creation of an environmentally aware consumer market that will preferentially seek and purchase certified peccary products and who will pay a premium price in order to help conserve the Amazon.

Perspectives of the Stakeholders in the Certification of the Peccary Pelt Trade

Interviews and workshops were conducted with the major stakeholders to determine their interest in setting up a peccary pelt certification programme. The results showed the following.

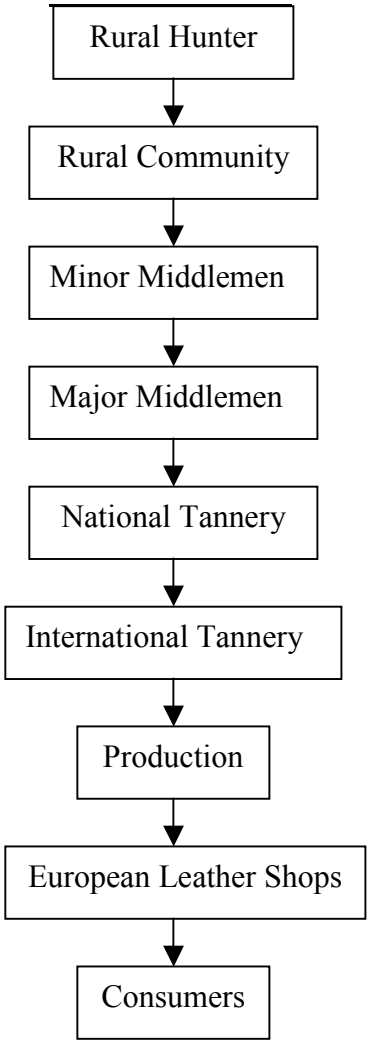

Figure 3. Chain of actors in commercialising peccary pelts

Perspectives of rural hunters

Rural hunters harvest peccaries primarily for meat and are interested in conserving peccaries for the meat resource. However, rural hunters agree with a certification programme for peccary pelts, because they see this as a way to conserve the bush meat resource and as a way to obtain added value from pelts. Currently, many hunters discard peccary pelts because the sale of pelts is not profitable. Communities that currently implement community-based wildlife management have been working with NGO's and these communities see the certification programme as a means of securing long-term support for their conservation activities. Hunters usually prepare the pelts twenty four hours after the animal had been killed, because they are busy preparing the meat. Hunters are interested in capacity-building to help improve the preparation of pelts.

Perspectives of the middlemen

Middlemen agree with a certification programme, because they want to conserve peccaries in order to continue working with the peccary pelt trade. Middlemen support certification because the programme will help them obtain a better quality of peccary pelts through capacity-building of hunters. They stated that the quality of peccary pelts has been deteriorating in past years. Today, only older hunters remember the professional pelt era prior to 1971. Preperation skills they learnt during that era are not being passed on to younger hunters, because of the insignificant price of pelts currently paid to hunters. Peccary pelts often arrive in collection centres 20 days or a month after animals have been killed, and this delay contributes to the poor condition of pelts. Middlemen stated that a main problem is a lack of better transport of pelts to collection centers.

Perspectives of the national tanneries and exporters

National tanneries and exporters of peccary pelts showed great interest in a certification programme for peccary pelts because they want to conserve peccaries to continue working with the trade and keep it open. National tanneries are willing to experiment with different pre-tanned marks to identify certified pelts, which could be recognized post-tanned to assure chain of custody of certified pelts.

National tanneries offered to colaborate with peccary pelts that come from certified communities. National tanneries also agreed that peccary pelts are becoming poorer in quality. They see certification as a way to improve quality of pelts and in turn reduce their losses. Tanneries also realise that certification will require a green market before any direct benefits can be gained by rural communities, and that benefits from added value will be increased if they work more directly with communities.

Perspectives of INRENA

INRENA agrees with a certification programme of the peccary pelt trade, because it provides a

solution for better management of peccaries and subsistence hunting. It will use the peccary pelt trade as a mechanism to implement wildlife management throughout the Peruvian Amazon. INRENA will also be able to have more information on peccary populations and more accurately fine tune annual peccary pelt quotas in Peru. INRENA acknoweleges that rural communities would use their wildlife resources more sustainably and obtain greater socio-economic benefits through a certification programme.

Perspectives of the Scientific Authority CITES (SAC) Peru

It is the responsibility of the Scientific Authority of CITES in Peru (SAC) to inform the Administrative Authority about international trade of peccaries. SAC will support the process of certification of the peccary pelt trade. SAC acknoweledges that certification of peccary pelts is a bottom-up process beginning with subsistence hunting at a local level and in turn represents an excellent oportunity to guarantee the sustainability of susbsistence hunting. Even more, SAC considers that certification will help manage peccary populations and their habitats integrally and will generate relevant information about peccary harvesting and the conservation status of peccary populations under hunting pressure. The certification programme will also help monitor international trade.

Perspectives of NGO's, research institutes and universities

NGO's, research institutes and universities agree with a certification programme for the peccary pelt trade. These institutions are willing to help rural communities implement community-based wildlife management for a certification programme. They can also provide technical assistance to communities about sustainable wildlife management and capacity building to improve the quality of peccary pelts. These institutions will be key to helping rural communities become certified.

Proposed Guidelines for the Certification of the Peccary Pelt Trade

As an initial stage certification of the peccary pelt trade will be done through a process of "green" labelling at a national level within Peru. At a later stage the certification will likely move to an international level and include FSC level certification.

Certification of the peccary pelt trade will be based on community-based wildlife management as the fundamental level, both in terms of the actual trade and in terms of species and rainforest conservation. Thus, the first stage of a peccary certification programme will be to certify rural communities who manage their wildlife sustainably. This will require the following.

- Rural communities should have community-based wildlife management plans that set limits on harvested species that are not vulnerable to overhunting and halt hunting of species vulnerable to overhunting. Hunting limits should be within sustainable levels. These plans should include all hunted species, not just peccaries;
- Rural communities should monitor and evaluate their hunting as an integral part of community-based wildlife management. This monitoring and evaluation can be in the form of hunting registers that include information on the species, number of individuals, date, and location hunted. Monitoring wildlife hunting should also include information on catch-per-unit-effort (CPUE). CPUE can be used to evaluate trends in wildlife abundance and be used to evaluate sustainability. The advantage of using CPUE is that it can be done by the communities with technical support.
- Rural communities will need to set up source-sink areas as part of their management plans. Areas with no hunting (source) should be set up near hunted areas (sink). Non- hunted areas will buffer against any unexpected fluctuations in wildlife populations and help guarantee sustainability of wildlife hunting in the long term.
- NGO's, universities and research institutions interested in wildlife conservation, sustainable use, and rural development should help communities gain certification.

A certifying body will need to be determined, and will likely be selected by an open competition or-

ganized by INRENA. A mechanism will also need to be set up that allows NGO's, universities and research institutions to provide capacity-building and technical assistance to rural communities. These institutions will need to be validated by the certifying body.

Peccary pelts originating from certified communities will need to be identified and marked, and a mechanism to track certified pelts through the pelt trade chain will need to be set up. To ensure a secure chain of custody, the rural communities will be considered as the original point of sale of peccary pelts. Rural communities that are certified will need to be monitored regularly by validated NGOs, universities and research institutions to ensure that communities continue to manage their wildlife sustainably. Therefore, these institutions will have an important role in 1) determining which communities comply with the standards required for certification, 2) helping rural communities become certified, and 3) monitoring sustainability of wildlife use within certified communities. The benefits for rural communities include, 1) rural communities that participate in certification will get technical support to improve the quality of pelts, 2) rural communities will have access to a secure market for certified pelts, and 3) with the supervision of validated institutions rural communities will place certification marks on pelts and keep a detailed register.

The role of the major middlemen will be to receive certified peccary pelts from certified rural communities, separate certified pelts from non-certified pelts and send them to national tanneries.

National tanneries will be working in close co-operation with the certifying body in implementing a certification programme. National tanneries will process the certified peccary pelts. After tanning the certifying body will place the "green label" on certified pelts. Certified peccary pelts with their respective "green label" will then be exported to the "green" market. The consumer will be informed that their purchase of a certified peccary product will help conserve the Amazon rainforests and its wildlife, whilst purchase of non-certified peccary product might result in further destruction of the Amazon and overhunting. Tanneries will work with the certifying body and validated institutions to develop a mechanism to return added value to certified communities.

Costs-benefits of the Peccary Pelt Certification Programme

Initially, costs of certification will be high, because the programme will have direct costs related to the certification process itself. Direct costs will vary depending on the number of communities applying for certification and the distance that certifiers have to travel. There will also be indirect costs. The major indirect cost will be investments needed to ensure that local communities set up sustainable wildlife management schemes that meet certification standards. This will often require that communities change unsustainable hunting practices to more sustainable practices, for them to develop community-based management plans, set up hunting registers and non-hunted source areas. Indirect costs of certification of peccary pelts will also include investments in transporting certified pelts from hunters to major middlemen.

To cover initial costs, it would be helpful to involve environmentally sensitive international development organizations such as the European Union, which currently has a South American peccary programme in Peru and Brazil. Currently, the major middlemen and national tanneries pay a pelt tax of 3.50 soles (US$ 1) to INRENA for each peccary pelt exported. INRENA currently uses these funds to conduct censuses of peccary populations. These funds could also be used to cover costs of certification.

The major benefit of peccary pelt certification is its use as a catalyst for community-based wildlife management. Communities that manage all their wildlife sustainably would participate in the certification programme and in turn, would be able to secure additional income from the sale the peccary pelts, and recognition as responsible environmentally sensitive communities that are helping to save the Amazon rainforest. These incentives would help communities convert unsustainable practices to more sustainable hunting. This will help conser-

vation, sustainability of wildlife use, rainforest conservation and help improve the living standards of rural communities. The peccary pelt certification programme would benefit major middlemen, national tanneries, and international leather industry, since it should help produce better quality of pelts and help keep the peccary pelt trade open. Finally, the certification would be beneficial for INRENA, because it would be an opportunity to realise effective wildlife management for the Peruvian Amazon with an emphasis on peccaries.

The peccary pelt trade is currently a marginal economic activity at all levels. Hunters gain more from the economic value of peccary meat than from pelts, which they consider as a by-product. Minor middlemen trade peccary pelts more as a secondary activity, with the trade of other natural resources being more important. Major middlemen earn a marginal living from the peccary pelt trade, and are often doing other activities to supplement their income. Peccary tanneries earn a reasonable living, but are not a high end business. Only one of the three peccary pelt tanneries in Peru also tans other types of leather, such as alpaca, bovine and merino pelts. The other two tanneries work exclusively with peccary pelts, which suggests that they are making a reasonable living from this industry. The fine goods manufacturers in Europe are having economic difficulties, and retailers sell some peccary gloves, but rely on the sale of many other types of leather goods for most of their income. In short, nobody in the peccary pelt trade is becoming rich and the certification process must realise that there will not be large supplies of money in the industry to support implementation.

Conclusion

Certification of the peccary pelt trade has important implications for managing bush meat hunting. Bush meat hunting will only be sustainable if it takes into consideration the social issues of poverty and sustainable resource use. It is impossible to shut down the bush meat trade, because it originates within rural communities that rely on wildlife meat for subsistence and market sale. The only viable solution is to managing bush meat hunting. One potential way for managing bush meat hunting in Peru is via certification of the peccary pelt trade.

Certification of the peccary pelt trade provides a mechanism to stimulate wildlife management at the local level of rural communities. It is therefore a bottom-up strategy that is based on the current pelt export trade. In addition, peccary pelts are a subproduct for rural hunters. Therefore, if the peccary pelt trade was shut down tomorrow, not one peccary would be saved, because hunters are harvesting peccaries for their meat, not for their pelts. Interestingly, the pelt provides a mechanism to manage bush meat hunting, because the pelt trade has an official chain of actors that are regulated by governmental imposed quotas and regulations.

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The introduction of red river hogs and bongo at the Los Angeles Zoo

Angela Anderson, Animal Keeper, Los Angeles Zoo
Jeff Holland, Curator of Mammals, Los Angeles Zoo
Robin Noll, Hoofstock Supervisor, Los Angeles Zoo

The Los Angeles Zoo has managed bongo (*Boocerus eurycerus isaaci*) and red river hogs (*Potamochoerus porcus*) for several years. Bongos have been managed since 1975 and red river hogs since 1990. Over the years the bongo population at the zoo had declined with the curtailing of breeding due to overrepresentation and the reduction of the number of bongo held in anticipation of a new holding area being built. At the same time the population of red river hogs at the zoo had grown from a single pair to a total of six animals with the arrival of two new pairs from Guinea. Due to space constraints it was necessary to become creative in how we would house our newly acquired red river hogs with limited space. At this time we had lost one of our elderly bongo females, which left only a single female bongo in a very large enclosure. Since we had previously housed bongo with yellow-backed duikers (*Cephalophus silvicultor*) and bat-eared foxes (*Otocyon megalotis*), it was felt that housing a pair of red river hogs with the single bongo would be feasible.

An elderly pair of red river hogs (the male is 7 years of age and the female is 14 years of age) was selected for the introduction since they are not as high strung as the younger pairs of red river hogs held at the zoo. It was felt that they would be calmer and less likely to spook the bongo. It should be noted that the female hog is missing one eye.

The red river hog pair was moved to the bongo barn and set up with their own stall and holding yard. The first two days the hogs were kept in back so they could get used to their surroundings. On day 3 the hogs were let out into the yard so they could get

used to the lay out of the enclosure. Over the next 14 days the hogs were let out into the enclosure on alternate days with the bongo. On all days the animals in the enclosure were given access to the back holding area so they could have visual access to one another in the adjacent holding yard. Both bongo and the hogs were fed along the gate to encourage them to approach one another. The bongo, after initially being startled by the hogs presence, was very calm being around them. The female hog appeared to have no interest in the bongo, while the male hog was definitely interested. When the bongo did appear in his field of vision he would approach the gate side-ways with ears laid back.

After day 14 it was decided to introduce only the female hog to the bongo, since it was thought the male hog would challenge the bongo. The introduction took place in the holding yards where it was felt there would be more control over the situation. The introduction went well and both animals ignored one another. On the following day both hogs were introduced to the bongo. Again the introduction took place in the holding area and the female hog and bongo ignored each other. The male hog was very curious of the bongo and walked straight up to her. The bongo lowered her head with her ears out when he approached too closely as a warning, but the hog continued to approach. The bongo then hit the hog on top of his body with her horns and rolled him over. The hog got back up and stood his ground and the bongo repeated the incident. At this point the keepers separated the male hog and bongo for fear that it would escalate further and the hog would get gored. The female hog was left with the bongo in the enclosure with no problems for the remainder of the day.

For the next 26 days only the female hog and bongo were put together in the enclosure. Both animals respected one another and gave each other plenty of room when they were in the same area. No problems were ever noted during this period. When the keeper was present in the area the bongo and female hog would be given access to the back area so the male hog could have visual access to both of them. All animals were fed along the gate to encourage visual access. At the end of each day the female hog was put back with the male hog and the bongo was separated into her own stall. The male hog continued to show curiosity in the bongo throughout this period of time.

Twenty-seven days after the initial introduction between the male hog and the bongo it was decided to try the introduction again. This time the introduction took place in the enclosure. It was felt that if more room were given for the animals to separate themselves on their own the introduction would be more successful. The bongo was let into the enclosure first and given about 60 minutes to eat her morning food, she then moved off to the far end of the yard to lie down. At this point both hogs were released into the enclosure and given their morning food at the opposite end of the enclosure. For the first 90 minutes the hogs spent much of

their time foraging in this area. After this 90-minute period the hogs began wandering toward the other end of the enclosure where the bongo was. The male hog eventually made his way toward the bongo and stood looking at her for several minutes without moving and then continued past her and moved back to the other end of the enclosure.

Eventually the bongo moved to the other end of the enclosure and began feeding in the same area as the hogs. The female hog had no concerns about the bongo's presence and continued foraging. The male hog however still wanted to assert himself and make contact with the bongo. He approached the bongo at which time she lowered her horns and hit him on top of his head. He appeared startled and backed off for a moment before going back towards her. This time she hit him on top of his head and pushed him back a bit. The hog seemed to have gotten the message after this incident and did not challenge the bongo again.

In the following days no other incidences were observed or acts of aggressive behavior noted. In fact the hogs now lay down during the day in close proximity to the bongo. Thus, a successful introduction has given us a very active and interesting mixed species exhibit. As of this writing the bongo and hogs continue to co-exist peacefully.

Hippopotamus of the W-Arli-Pendjari-Oti-Mandouri-Keran Ecosystem. West Africa. Status, distribution and conservation issues

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Summary

For the first time in April 2003, an aerial total wildlife count of the entire "W-Arli-Pendjari-Oti-Mandouri-Keran" (WAPOK) Ecosystem, the largest savannah ecosystem of West Africa, has been conducted.

During this survey, Hippopotamus have been observed 51 times, totaling 696 individuals. An average of 13.86 ± 16.73 individuals was noted. The group size varied between 1 and 65 individuals.

In the WAPOK ecosystem, the future of hippopotamus is ensured by the tourism activity in the area and the redistribution of tourism revenue to human communities living around the ecosystem, thanks to several conservation project, but more certainly, to the conservation initiative of several private stakeholders.

Résumé

Pour la première fois en Avril 2003, un comptage aérien total de la faune sur l'entièreté de l'Ecosystème "W-Arli-Pendjari-Oti-Mandouri-Keran" (WAPOK), le plus vaste écosystème de savane d'Afrique de l'Ouest, a été mené.

Les hippopotames ont été observés 51 fois totalisant 696 individus. Une moyenne de 13.86 ± 16.73 a été calculée. La taille des groupes variant entre 1 à 65 individus.

Dans l'écosystème WAPOK, l'avenir de l'espèce est assurée par les activités touristiques et la redistribution des revenus du tourisme aux communautés riveraines vivant autour de l'écosystème grâce à plusieurs projets de conservation, mais plus certainement, aux 'initiatives de conservation de plusieurs concessionnaires privés.

Introduction

Little is known about the status of the Hippopotamus in West Africa. This species is rarely the subject of research in this part of the continent.

For several years, in fact for several decades, some parts of the Ecosystem were surveyed both by air and ground counts carried out more or less on a regular and frequent basis. (Green 1979, 1988 ; Bousquet 1982 a,b ; Delvingt 1987 ; Roth & al 1991; Marchand & al., 1993 ; Barry & al 1998, Chardonnet & al.,1999 ; Bouché 2000; Sinsin & al. 2000, 2001, 2002 ; Rouamba & al. 2002 a,b,c) while other parts were rarely or never counted. The

hippopotamus has never been counted except by Bousquet (1982), Delvingt & al (1989) and Sinsin (2001) along the Pendjari River.

For the first time in April 2003, thanks to the CITES-MIKE and ECOPAS programmes as well the PAUCOF project, we had the opportunity to conduct a survey at the scale of the whole ecosystem in the same time and to have therefore a more consistent idea of the real status of the Hippopotamus in it (Bouché & al. 2004).

Study area

The WAPOK ecosystem is located in West Africa between 9°95 and 12°85 North latitude and between 0°40 and 3°40 West longitude. It covers an area of 31,231.17 km. The Ecosystem is shared by 4 countries: Benin, Burkina Faso, Niger and Togo and constitutes a complex of National Parks and associated protected areas with different conservation status (Figure 1).

This ecosystem is located in the sudano-sahelian domain. The weather is characterised by three seasons : a dry cool season from November to late February, a humid hot season from March to May, and a rainy season between June and October. The Harmattan, a dry cold wind from the North East, blows during the dry cool season, while during the rainy season a monsoon wind blows from the South-West.

The average annual temperature varied between 28°C and 34°C with average temperature amplitudes of 10 to 15°C. The WAPOK Ecosystem is located between the 600 and 1,200 mm isohyets. The rainfall follows a unimodal rhythm.

The majority of water sources are distributed along the seasonal streams which drain the Ecosystem of which the most important are the rivers of the Niger, Mékrou Pako, Alibori, Oti, Pendjari, and their affluents called the Koakrana, Kourtiagou, Arli, Tanouarbou, Doubodo, and Singou. The main rivers (Niger, Pendjari, Mékrou Oti and Singou) are the only ones which can maintain water throughout the year. Several permanent ponds spread throughout the ecosystem also provide water for wildlife during the dry season.

The habitat is characterised mainly by shrubby savannahs to woodland. A progressively heavier woody density is noticed as one moves towards the South. Along the main rivers, occur forest galleries, themselves bordered in some places by grassy plains. The dominant species are Combretacea *Terminalia spp.* and *Combretum spp.* as well as *Acacias*, including *A. seyal, A. senegal* and *A. dudgeoni*.

Methodology

In order to count animals of the WAPOK Ecosystem, a total aerial count has been conducted (Norton-Griffiths 1978, Douglas-Hamilton 1996, Bouché 2001, 2004).

The ecosystem was divided up on a digitised map into daily counting zones of 2,000 up to 3,000 km². Each daily counting zone has been divided into 6 blocks. Each block was covered by one aircraft and his crew. Five Cessna 172 and an one Cessna 175 aircrafts have been used simultaneously for this survey. In each block, flight lines ran from East to West. The interval between lines was 1 km in order to scan the entire surface of the block. Each flight line was extended 2 km beyond the limits of the block to create an overlap into the neighbouring blocks.

Each crew included a pilot in charge of the aircraft piloting and the navigation along the flight lines drawn on a GPS display placed in front of him, a front seat observer in charge of the data recording on a datasheet and the waypoint recording on an other GPS and two rear seat observers in charge of the animal counting and the communication of the observations to the front seat observers.

Hippopotamuses were counted individually and their exact position was recorded by GPS. Large groups (more than 10 individuals) were photographed.

An average of 6 to 7 flight hours per day was necessary to cover the daily flight plan. The flights began in the morning between 05:45 and 06:00 and continued until the entire daily flight plan was completely executed.

The flight height was adapted according to the con-

ditions (visibility, type of vegetation, etc.). The average height was situated between 200 and 400 feet.

The flight speed was fixed between 130 and 150 kph. The latter could reach 175 to 195 kph in case of back wind.

Results

This survey was undertaken in April and May 2003 during the humid hot season. In total, the 6 aircrafts flew 287.93 flying hours, for the counting itself, thus an average scanning rate of 108,47 km²/ hour. A total of 45,579.08 km devoted only to the count have been covered during the survey, this represents an average speed of 158.3 kph.

Even if this survey was not a specific hippopotamus count, each river has been extensively scanned. All observations of a same river have been made in a very short time (e.g one or 2 successive days for each main river: Niger, Pendjari, Mékrou, Doubodo, Tanouarbou, Oti). All risk of double counted groups have been eliminated systematically by comparing the group size and position with the help of GIS. In each main river, 95 to 99% of the observations have been recorded the same day.

The results recorded for the hippopotamus can be summarized as follows :

Rivers	No of obs	No of ind
Pendjari	41	617
Tanouarbou	1	17
Doubodo	4	42
Mékrou	1	3
National Parks out of rivers		
PN Pendjari	1	4
PN Arli	3	13
Total	51	696

Table 1. Number of observations and individuals of Hippopotamus

Burkina Faso and Benin share, along the Pendjari River, the largest part of the Hippopotamus population of the WAPOK Ecosystem (Table 1 and Figure 1).

An average of 13.86 ± 16.73 (SE) individuals was noted. The group size varied between 1 and 65 individuals.

This estimate certainly remains a minimum for the Ecosystem. Although if it can be assumed that the tributaries are dry during the season in which the count was conducted, no hippopotamus was seen in the River Niger along the "W" National Park in Niger (whereas its presence is confirmed) The left bank of the Niger River was occupied by fields, cattle, temporary and permanent human installations. On the other hand both sides of the Oti River in Togo were completely invaded by fields and no individual has been recorded there. A single observation of hippo has been made in the Mékrou River but it must be mentioned that during the survey, cattle occupied large parts of "W" National Park of Benin that influenced wildlife distribution up to the Mékrou River.

On the other hand, all the hippopotamuses have been observed while they were in the water. It is therefore obvious that several individuals could be missed, if they were submerged, or hidden under the part of the forest gallery's canopy that covers, in some places, a part of the river along the banks.

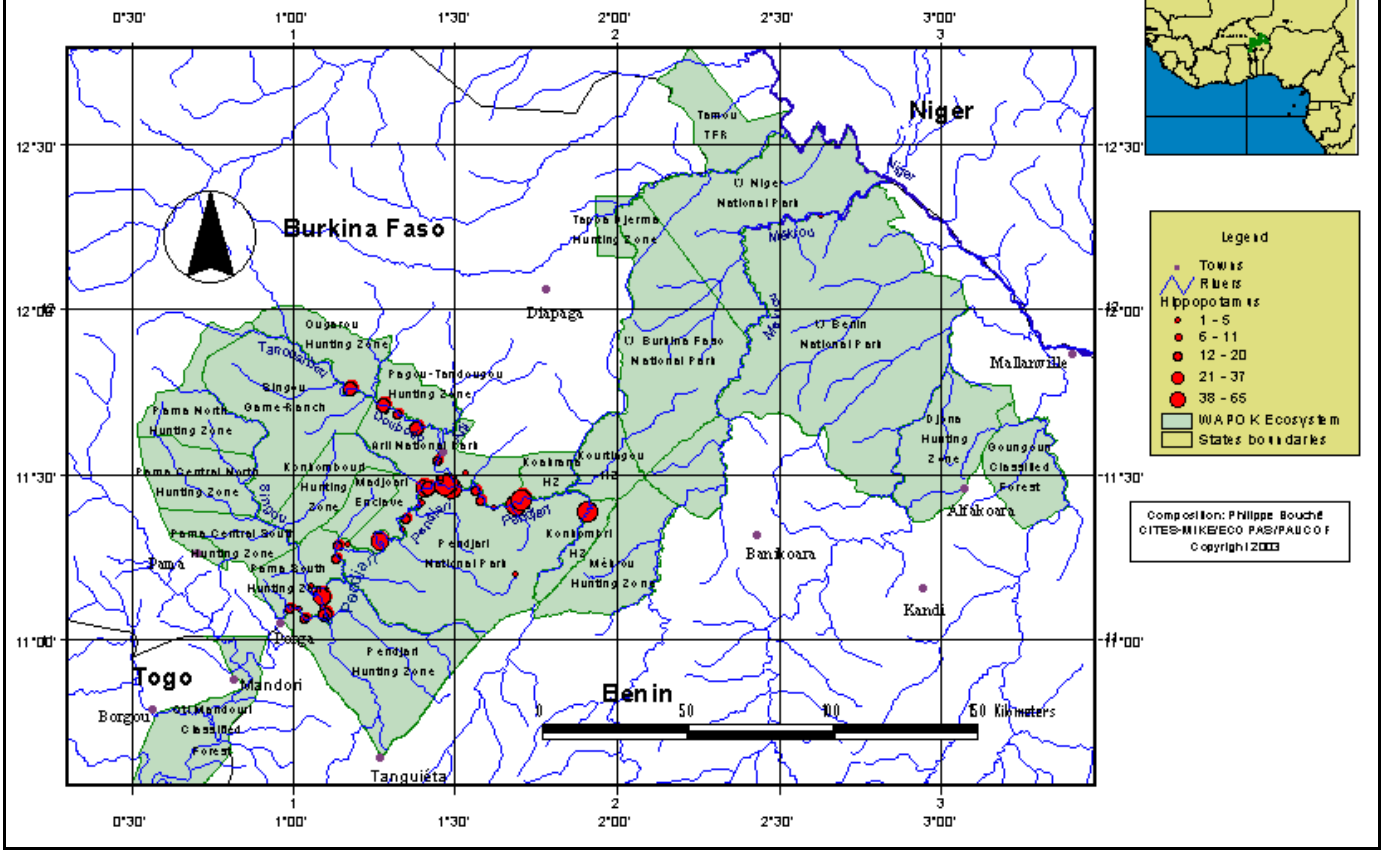
Conservation issues

The West African hippo's future is threatened by the loss of habitat due to expanding human populations, the increase of agricultural and pastoral activities but also by the modifications of waterways (Bouché, 1999; Roth & al. 1996; Eltringham, 1999).

All along the borders of the Ecosystem, 35,000 inhabitants live on the Burkinabé side, while 30,000 inhabitants live along the borders of the Pendjari National Park and Hunting Zone. On the Burkina Faso side exists the Madjoari enclave in the middle of the Ecosystem (Figure1). In 1996, the total population living in the enclave was 5,810 inhabitants (Bouché & al. 2000). The subsistence agriculture and pastoralism are the main activity for the populations living around the ecosystem. Fishing is also practised in and around the whole ecosystem mainly along the rivers Doubodo, Arli, Pendjari and Niger (Bouché & al, 2004).

In this context, the WAPOK ecosytem shelters certainly one of the most viable hippopotamus popu-

Figure 1. Hippopotamus number and distribution in the WAPOK Ecosystem. Aerial total count. April-May 2003.



lation of West Africa. This viability is certainly due to the hippopotamus population size itself but also to the quite high level of protection mainly along the Pendjari, Arli and Doubodo rivers and to some extend along the Mékrou River.

The future of hippopotamus in the WAPOK Ecosystem is ensured by the tourism activity in the area and the redistribution of tourism revenues to human communities living around the ecosystem, thanks to several conservation projects, but more certainly, to the conservation initiatives of several private stakeholders.

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Preliminary study on traditional pig raising by local communities at upland Kebar, Manokwari, West Papua.

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Pigs are the mostly highly valued animals, both socially and culturally, in West Papuan society. The subject of this particular study is the tradition of pig rearing, a skill which is handed down from generation to generation. Traditional pig rearing has been the subject of a previous study by the Animal Science Department of Papua State University (PSU) who conducted research in various parts of West Papua. In our study we focussed on development of local pig husbandry within the framework of the traditional system. Our study was financially supported by an outreach grant from the Mennonite Central Committee (MCC) in collaboration with the Center of Public Services of PSU.

Figure 1 Pigs were uprooting and foraging on remaining tubers and root crops

One aspect of traditional pig rearing of particular interest and concern is the genetic contamination of wild pig populations in West Papua. In our preliminary studies in Kebar we found that it is quite common for domestic pigs to breed with free ranging feral and/ or wild pigs, either deliberately managed or accidentally. The purpose of this paper is to present the information obtained from our study and to provide a basis for conducting research on hybridisation of wild pig with free ranging feral or domesticated pig.

Our findings:

1. Pigs are usually raised within a backyard farming system, fenced in and in close proximity to the house (Figure 1). Their diet consists of both cooked and uncooked kitchen and household leftovers, such as rice, vegetables and root crops. Pigs are also raised in agricultural plots located far from the house. These plots may be previous swidden areas with some crops still remaining, which the pig lives off. Here the pig performs the dual

Figure 2 Family members will take care of the pregnant female pigs

function of maintaining the soil through digging and fertilizing the soil through its faeces. After a certain period the pig will be removed and placed in another swidden area.

2. Pregnant sows receive priority attention and as such are kept close to the dwellings and given good quality food and shelter. Sometimes the sows live within the house receiving special treatment such as baths (Figure 2).

3. Where people live far from the main village and have access to more land, livestock are raised in a much more free-ranging style around the house and garden. In these situations pigs often searched for their own food utilising areas right up to the forest edge. It was not uncommon in these situations for female domestic pigs to mate with wild boars, a chance happening which the farmers did not actively try to avert. It is believed that the offspring of such mixtures are more aggressive, produce good quality meat, and are stronger than pure domestic pigs in terms of immunity to diseases, finding food, and reproduction. Such outcomes mean that farmers are quite in favour of crossbreeding. An additional benefit is that farmers do not need to practice the dangerous activity of hunting wild boar as much because they have a good source of meat from the crossbred pigs.

The crossbred offspring receive special treatment due to the wild behaviour inherited from the sire. These piglets are bathed intensively, most often rubbed with bananas (or banana leaves?, Ed.) warmed on the fire. In addition these piglets are given a tour of the surrounding area from the luxury of a small basket ("noken" basket made from plant fibres) on the owners back or with a rope tied round their neck like a lead (Figure 3)).

Figure 3. Female farmer with her two piglets on the way to her garden.

Rapid assessment of the status of *S. verrucosus* on Java and Bawean

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Abstract

We conducted an interview-based survey of the Javan Warty Pig *Sus verrucosus*, an endemic of the islands of Java and Bawean in Indonesia. Here we provide an overview of the main results; more detailed information is provided in a report and a recently submitted paper. Our results suggest that the species occurs in 10 isolated populations, while some additional smaller populations may remain. In comparison with data from before 1940 and from 1982, this indicates a rapid population loss. Our results suggest that this loss is primarily caused by a loss of crucial lowland forest and forest plantation habitats and high hunting pressure.

Introduction

The Javan warty pig *Sus verrucosus* is endemic to the islands of Java and Bawean in Indonesia. It occurs alongside the Indonesian wild boar or 'banded pig', *S. scrofa vittatus*. Olivier (1925) mentioned that in West Java both pig species were common and occurred in similar habitats from coastal to montane forests. More recent studies indicated that the two species avoid each other and attain their highest densities where the other species is absent (Blouch 1988; 1993).

Blouch (1988) who surveyed the two pig species in 1982 found that *S. verrucosus* was reasonably secure, but more recent information suggested that habitat loss, hunting, and competition and hybridization with *S. scrofa* possibly threatened its survival. We therefore initiated a follow-up survey to reassess the status of *S. verrucosus*.

Methods

We conducted the survey on Java and the island of Bawean, which is situated some 125 km north of Java. Presence and absence data for *S. verrucosus* were primarily gathered by GS and local field assistants, who interviewed local informants, conducted field inspections, or tried to obtain other evidence, such as hunting trophies (see Fig. 1). We realize there are drawbacks to interview-based survey techniques as it is very difficult to assess the accuracy of the given information. Nonetheless, ethnobiological surveys constitute an important, possibly crucial, means of rapidly accumulating presence/absence data and identifying human-induced threats and attitudes. GS also visited the three zoos on Java with captive *S. verrucosus* population to assess their breeding success.

Results

During our field surveys we conducted interviews in 85 different locations, of which 4 were zoos. Six interviews did not result in any useful data as the interviewees had no knowledge of these animals. The information from 26 of the 75 field interviews strongly suggested that *S. verrucosus* was locally present; 13 interviewees suggested that *S. verrucosus* no longer occurred in the area and 26 were unfamiliar with any other pig but *S. scrofa*. In the remaining 10 interviews it was unclear whether *S. verrucosus* still existed (e.g., last reported sightings 10 or more years previously; for details see Semiadi and Meijaard, 2004). Our survey indicated that, between 1982 and 2003, 17 of the 32 (53%) *S. verrucosus* populations identified by Blouch (1983) had been extirpated or dropped to levels so low that local hunters had failed to encounter the species in recent years. Our data suggest that there are about 10 areas on Java and Bawean where *S. verrucosus* populations survive, although small groups may exist elsewhere.

Most interviewees reported population declines both of *S. verrucosus* and *S. scrofa*. High hunting pressure, logging of tree plantations, and dispersal of pigs to other regions were general considered to be the most important causes of these declines. Hunting pressure is clearly a major threat to both *S. verrucosus* and *S. scrofa*, given that almost all interviewees regarded these animals as a major agri-

Fig. 1. One of the hunting trophees, a male from Lumajang, East Java, found during the survey providing evidence for the presence of *S. verrucosus*

cultural pest. Pigs are either hunted by village groups or organized hunting groups. The main reason for hunting was to control pig populations and thus the damage to croplands. However, pigs are also hunted for commercial purposes in various areas across the island. In the area between Sumedang, Majalengka, and Ciamis, pigs were captured alive for organized fights between dogs and pigs. These so-called *Adu Bagong* are traditional events in which dogs like Dobermans, German shepherds or Pitbull Terriers fight wild pigs in a fenced-off arena. *S. verrucosus* males are especially sought after because of their large size, aggression, and stamina.

None of the zoos on Java appeared to have a properly structured conservation breeding programme for *S. verrucosus*. The animals in the Yogyakarta and Jakarta Zoos (Fig. 2) had not bred despite animals being kept 8 and 10 years respectively. Those in Surabaya Zoo might have been cross-bred with *S. scrofa*.

Discussion

The differences between the distribution ranges drawn by us and by Blouch (1983; 1988) are striking. It is unclear to what extent these differences can be explained by dispersal of *S. verrucosus* populations, local population decline, or methodological differences between Blouch and us. Our interview data support a general decline of *S. verrucosus*, with many interviewees remembering the species from several years or a decade ago, but not having encountered it in recent times. Interview data pertaining to relative kill rates provided further evidence of such declines; i. e. with average numbers of animals reported killed having dropped from 3-10 pigs/hunting excursion 15 years ago to between 0 and 2 pigs in 2001. The main reasons for the rapid population decline appear to be loss of suitable lowland forest and plantation forest habitats, over-hunting, and possible competition with *S. scrofa*.

Recommendations

We recommended the following to improve the survival chances of *S. verrucosus* in the wild:

- Effectively protect selected *S. verrucosus* populations in the wild
- Lobby the Government for giving protected status to *S. verrucosus*
- Investigate crop damage by *S. verrucosus*

Fig. 2. *S. verrucosus* in Ragunan Zoo, Jakarta

- Develop research projects on *S. verrucosus*
- Establish properly structured conservation breeding programs, utilizing any available pure-bred stocks and supplementing these with additional founders where necessary

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Note:

Details on this survey are presented in a report and a paper recently submitted to Biological Conservation. The full report can be obtained as a pdf-file from the authors.

Re-Assessment of the conservation status of hippo species points to problems

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The last Red List assessment for the two hippopotamus (the common hippo - *Hippopotamus amphibius* and the pygmy hippo – *Hexaprotodon liberiensis*) species was conducted in 1995. Since then, there have been substantial developments and events that warranted another evaluation of the IUCN Red List Categories and Criteria as they apply to these species. Efforts to update the existing population information were initiated by the Hippo Specialist SubGroup in January 2004. This included email questionnaires to researchers with field experience or to representatives of national wildlife agencies, a review of current published literature, grey literature from non-profit wildlife organizations, and reports from national wildlife agencies.

The Hippo Group concluded that the conservation status of both common and pygmy hippos has worsened since 1995 and are recommending higher threat categories for both species. For common hippos, the recommendation was to upgrade this species to Vulnerable based on evidence of dramatic population declines in key countries, reports of widespread poaching from several countries, and the rising number of CH-human conflicts. Most recent population estimates suggest that over the past 10 years there has been 7-20% decline in CH populations. The recommendation for pygmy hippos reflects the serious conservation crisis this species faces. Evidence of rapid habitat loss (from intense logging), and increasing reports of subsistence hunting for pygmy hippos in logged areas meets the criteria for the Endangered category.

Both recommendations were submitted to the IUCN Red List Committee by the 2004 deadline and must now be independently evaluated. Any change in Red List status will be released once finalized.

Giant Forest Hog *Hylochoerus meinertzhageni* in Queen Elizabeth National Park, Uganda

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Along the north shore of the Kazinga Channel in QENP forest hogs were in the past restricted to the dense bushland of the Leopard Loop area. Since the early 1990s that population increased and extended its range westward into the more open bushland-grassland-mosaic including the Mweya Peninsula where they had never been recorded before.

In 1995 we started this ongoing study of behavioural ecology, social organisation, behaviour and population ecology etc. Major method was and is direct observation of >100 individually known hogs. Adults and subadults are recognised from their individual facial wrinkle and fold patterns, using b/w close-up portraits, produced with a slr camera and lenses of up to 600 mm. In addition shape and size of canines, cuts and notches in the pinnae and scars were used. Infants and juveniles are identified via their mothers. Some individuals had radio transmitters fitted for quick localisation.

After extended presence of the observers the hogs in the 50 km² study areas became habituated to the vehicle and can be observed at close range. Life histories, group composition, activity pattern and range utilisation are monitored.

Social organisation is characterised by stable non-territorial family groups consisting of an a-male, 1-3 rarely 4 females and their young. Females stay in the group until death. Old and incapacitated ones are looked after by other group members who wait for them, answer their calls and search for them when they got lost. Male tenures have so far been recorded as up to 7 years.

Group sizes ranged from 2, the monogamous pair, to >20 members. Largest group consisted of 24 including 8 infants of which only one survived the next dry season. Generally, only the a-male has access to the females, but extra group copulations occur. The core group of females is stable even in the absence of the a-male. Large groups split.

Daughters remain in the group as adults and become permanent members. Thus female group members are closely related as sisters and mother-daughter.

Adolescent sons leave voluntarily and move away. When fully grown at age 5+ they compete with a-males for the possession of a family.

Fights for the possession of a group are unritualised frontal combats which may result in severe injury; even skull fractures are reported (Kingdon 1979).

When meeting in the overlap zones of their home ranges, neighbouring groups usually avoid contacts and retreat. In the dry seasons fights are not uncommon. They are mainly between the females and

consist of chasing and running, rarely with physical combat. Eventually both groups retreat in their original composition.

Females are intolerant of non-group conspecifics. In their home range they attack and chase any females and young that have lost contact with their respective families. We have no evidence for adoptions or integration of aliens.

After take-overs of families by a new male, infant mortality is particularly high, up to 100%, obviously caused by infanticide. Several unsuccessful (for the new male) infanticidal attacks were observed.

During the first years of the investigation the population increased and reached, in the Mweya study area, a density of >10 /km². The causes are considered to be increased food availability due to the decline of the elephants and reduced predation pressure due to the decline of the lions.

Since the beginning of this study the forest hog densities were to some extend fluctuating. However, during the last 2 years the densities in the study areas declined considerably: on the Mweya Peninsula by 30%, and in the 2 other study areas by 70 - 80%. Causes are

- competition with other herbivores
- nutritional stress especially in the dry seasons
- low reproductive rate/recruitment rate
- predation by lion, leopard and hyena
- road kills
- emigration.

The impact of the various factors is investigated. If the present trend continues the population will perish within a few years.

Previous reports:

d'Huart JP 1991: Bongo 18, 103-118, Berlin

Kingdon J 1979: East African Mammals IIIB, London

Kingdon J 1997: African Mammals. London

First (and last?) breeding loan export of Visayan (Negros) warty pigs

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On 28th April, 8 (4 ♂♂4 ♀♀) Visayan warty pigs (*Sus cebifrons*) of Negros island origin, arrived safely in Poznan Zoo to commence 6 months quarantine, pre-entry to the Netherlands. These animals, all of which were bred in captivity in two local breeding centres on Negros, were exported to Rotterdam Zoo (via Poznan quarantine) on breeding loan from the Philippine Government, under the aegis of a Memorandum of Agreement between the Department of Environment & Natural Resources (DENR) and Rotterdam Zoo. This MOA, and a similar MOA with Zoological Society of San Diego covering Visayan warty pigs of Panay Island origin, formalise the 'Visayan Warty Pig Conservation Programme', which also includes a range of related research, habitat protection, public awareness, local institutional capacity building and personnel training activities.

The breeding loan was important, partly because it represented the culmination of 12 years effort, partly because it was the first ever breeding loan of Negros animals (a Negros endemic subspecies, *S. c. negrinus*), partly because it was accomplished a few days before Poland joined the EU on 1st May (after which date any further imports of wild ungulates into Europe appear unlikely), but mostly because it may well constitute the last, best chance of securing a pure-bred population of this critically endangered subspecies, which can be cooperatively managed within the European quarantine boundary.

S. cebifrons is both one of the most distinct members of the genus *Sus* and of the world's most endangered large mammals. Already extinct over at least 95% of its former range, the last few remaining populations survive in the last few remnant

Loading in Bacolod City Airport, *en route* to Manila (27.4.04); photo: Cristina Georgii

forest patches on Negros and Panay, in the central Philippines. Owing to very ineffective protection by the relevant authorities, these last few populations and their habitats are unfortunately still subject to continued, sometimes severe, attrition (viz: agricultural encroachment, wildlife and timber poaching and retaliatory persecution for crop damage, etc). However, the most pressing - and seemingly irreversible - threat to this species is genetic contamination though hybridisation with free-ranging domestic and feral pigs introduced by farming communities throughout the region. Consequently, many so called *'baboy do mor'* killed by poachers now show obvious hybrid or feral characters (e.g. short snouts, large ears, reduced manes, sway backs, some even having piebald markings).

The conservation breeding programme was initiated in 1992 under the auspices of the 'Philippines Biodiversity Conservation Programme', with funding assistance from the Zoological Society of San Diego, Los Angeles Zoo and other agencies. This Programme effectively amounted to a 'race against time' to secure a pure-bred founder breeding population whilst the opportunity still existed. Unfortunately, the only feasible means of acquiring founders was via rescue or confiscation of illegally captured animals, most of which are killed during or following capture, but which were also occasionally offered for sale in local meat markets - albeit often badly injured through snare wounds. Notwithstanding likely difficulty of acquiring sufficient numbers of wild-born founders to meet normal, longer-term genetic and demographic management requirements, it was also decided to try to establish separate breeding stocks of Negros and Panay animals. These two populations have been physically and (presumably) genetically isolated since the end of the last ice age (c. 12,000 yrs BP), and differ in appearance in some respects (e.g. length of mane and pelage colour of adult boars). Consequently, the Panay animals may also constitute a new (i.e. as yet undescribed) subspecies, though the requisite genetic and morphometric (especially cranial) studies have been hampered by restrictions on the export of comparative material.

The first 'pure-bred' animals of Negros origin were acquired in 1992 by the 'Center for Studies in Tropical Conservation (Centrop) of Silliman University (in Dumaguete City, Negros Oriental) and the first animals of Panay origin in 1993 by Mari-it Conservation Park of West Visayas State University (in Lambunao, Iloilo Province, Panay.). In 1995, the first-ever captive births were recorded; initially on Panay, and later the same year on Negros. During

Arrival at Poznan Zoo, Poland (28.4.04); photo: Radoslaw Ratajszczak

Negros warty sow with (*S. c. negrinus*) with litter at A.Y. Reyes Zoo-botanical Garden (Centrop, Silliman University, Dumaguete City, Negros Occidental); photo: Cristina Georgii

the following five years, rather better progress continued to be made on Panay, partly owing to the early accession of 6 wild-born founders and partly through better management; whereas fewer founders, coupled with recurrent management problems resulting in poor survivorship of progeny, slowed progress on Negros. However, the latter problems were eventually resolved by changes in management personnel and the involvement of a second breeding wildlife centre on Negros; i.e. the Negros Forests & Ecological Foundation's Biodiversity Conservation Center (NFEFI-BCC) in Bacolod City, Negros Occidental.

The first-ever breeding loan export of this species occurred in September 2001, when 10 (4♂♂6♀♀) captive-bred warty pigs were exported from Mari-it to San Diego Zoo, via USDA quarantine in Warsaw (Poland) and Newburgh (USA). Unfortunately, two (2 ♂♂) of these animals died in transit and two more (1♂1♀) died during quarantine, though the surviving 6 (1♂ 5♀♀) had increased to 19 (9♂♂10♀♀) within a year of arrival. It is to be hoped that the increasing population of these animals can be cooperatively managed in North America (and possibly Australia); whereas the recently imported Negros animals, may be similarly, but separately, managed within European collections. The main purpose of these exports was to establish pure-bred populations within these two networks of co-operating institutions, which is simply not possible within the Philippines owing to the existence of few other institutions willing and able to manage this species. Nonetheless, efforts are underway to encourage more local institutional involvement, not least because of growing captive population pressures in the 3 local centres (the recently exported have already been replaced by new births), and to actively explore the few available options for possible future reintroduction projects.

Mating pair of Negros warties (*S. c. negrinus*) at the NFEFI-Biodiversity Conservation Centre, Bacolod City, Negros Occidental: photo: Juan Cornejo.

Brief Conservation News

Brief conservation news (1)

Swimmer in distress off the Catalonian coast turns out to be a Wild Boar

Source: http://actu.voila.fr/Article/article_insolite_031210110851.94wfizw4.html)

Barcelona, 10 December 2003.

A wild boar was fished out of the sea by the Catalonian civil guard yesterday after they mistook it for a swimmer in distress, reports AFP.

A spokesman said the beast must have swum for at least two days to reach the point - three kilometers offshore - at which it had been picked up. He blamed heavy rain, and said that the boar could have fallen into a watercourse and been swept downstream to the sea.

Once the rescue team had established that the "swimmer" was a 50kg boar, they "had a little difficulty in bringing it onboard", the spokesman explained, since it was "struggling a great deal. That's what you would expect from an animal like that. They attack to defend." He added that the boar was suffering from hypothermia, but was not yet totally exhausted. "Who knows where he may have come from? Perhaps the Balearics," he said.

Brief conservation news (2)

Curly-tusked boxing pigs rejoice

Source: BBC News Online, February 16, 2004 By Alex Kirby, BBC News Online environment correspondent

A wild pig found only in Indonesia will be a little safer, thanks to the near-doubling of the reserve where it lives.

The babirusa, known for its distinctive curly tusks, is found only in Sulawesi and some neighbouring islands, and now numbers fewer than 10,000 survivors. The government of Gorontalo province on Sulawesi has increased the size of the animals' stronghold, Paguyaman forest. A UK scientist and a team of Indonesian colleagues have pioneered new ways of conserving the forest to keep it safe.

Wildlife treasure trove

Paguyaman, home to many of Sulawesi's babirusa, is being increased from 31,000 to 52,000 hectares (from 120 to 200 square miles). It also harbours many other species endemic to Sulawesi (creatures found nowhere else), including the anoa, a type of buffalo, a tiny nocturnal primate called the spectral tarsier, and more than 100 bird species. Paguyaman

was designated as a protected rainforest reserve in 1999, but illegal logging and slash-and-burn agriculture continued to eat it away.

Dr Lynn Clayton, a British zoologist, has spent the last 15 years in Sulawesi studying the babirusa population (the name means "pig-deer"). With a team of Indonesian colleagues which includes scientists, forestry department officials and former hunters, she has helped to introduce new methods of forest conservation. Elite special police forces patrol the reserve with local people, an initiative which has seen the end of illegal logging from within Paguyaman. Formerly, ten rafts of illegal timber passed the project's field camp daily.

Forest pugilists

Special education and publicity programmes reinforce the message, and 8,000 teak trees planted outside the reserve provide villagers with a buffer zone crop. One of Paguyaman's distinctive features is a natural salt-lick where the babirusa congregate in large numbers to devour the mineral-rich soil.

An adult animal weighs up to 100 kilograms (220 pounds), and is the only mammal in the world in which the upper canine teeth in males are completely reversed, emerging not from the upper jaw but through the skin of the snout. Two other tusks curve out from the lower jaw. Another singular characteristic is the males' habit of rearing up on their hind legs and appearing to box with one another as they try to assert their dominance. The estimate of up to 10,000 live babirusa in the wild may be much too optimistic: some experts think the true figure is half that.

Losing the taste

The babirusa have suffered badly at the hands of poachers, who trap them in string leg snares for their meat. But the Paguyaman project worked with local officials to bring about the first completed prosecution of a babirusa trader in 2002. As a result of this and other anti-poaching steps, it says, the number of animals sold in local markets has fallen from 15 a week in 1991 to two a week now.

The project is supported by the UK's Darwin Initiative for the Survival of Species and the Foreign and Commonwealth Office's Environment Project Fund.

Brief conservation news (3)

Wild boar may be making comeback

Source: BBC News online Friday, 16 April, 2004

A wild boar carcass found in the Forest of Dean could be evidence the species is making a comeback to the area. The animal, which was hit by a car, was at first thought to be one that escaped from a Cinderford abbattoir in January. But experts say it is not the same boar and may be from a herd known to inhabit woods a few miles away in Ross-on-Wye.

Wild boar were hunted to extinction in Britain 300 years ago, but escapees from commercial farms have established new colonies. The prospect of free-roaming herds returning to area is of some concern to Forest Enterprise, which manages the local woodlands.

Wild boar can be aggressive if threatened

Wild boar can cause a lot of damage to trees and can be aggressive if threatened.

Rob Guest from Forest Enterprise said: "There probably won't be much danger to yourself as these animals are quite shy and would probably run away.

"But if an uncontrolled dog became tangled with a boar, that's where the potential for problems would lie."

Brief conservation news (4)

Berliner bitten by break-in boar

Source: BBC News on-line, 7 January, 2004

A German man ended up in hospital after being attacked by a wild boar which broke into his Berlin apartment. The animal, searching for food, bit the man's leg before escaping back to the woods, police told Reuters news agency. "The wild boar broke into the living room through a terrace door and hid under a table," said a police spokesman. He said that when the man tried to shoo the boar back out the door "it went wild".

The injured man, 54, was treated in hospital for his leg wound and released on the same day. Police said the animal had not been captured. Environmentalists say several thousand wild boars, which can reach sizes of 150 kg (330 lbs), live around Berlin and push further into the city when their food supplies are low.

In England, a wild boar was spotted trotting into a supermarket in Gloucestershire before fleeing when confronted by shop staff on Wednesday. A number of boars are believed to live wild in the nearby Forest of Dean and there are reports of about 1,000 on the other side of the country in Kent and East Sussex.

New website—PigTrop ... everything you ever wanted to know about pigs in tropical regions

http://pigtrop.cirad.fr/en/index.html

Pig production and pork commodity chains in developing countries now have their own site. It mainly addresses stakeholders involved in the pig commodity chain, but also anyone else with an interest in tropical pig breeding. It is run by the French Agricultural Research Centre for International Development (CIRAD). Among others it discusses new publications, special issues, past and upcoming events, research issues, results, current projects. It also gives an overview of publications on pig production in tropical areas.

The research part of the site has more detailed sections on:

Animal health: disease surveillance, epidemiology; diagnostic and vaccines

Animal Nutrition: alternative raw materials & by-products; nutritional requirements under tropical conditions; economical feeding strategies;

Genetics & Biodiversity : resistance genes; heat adaptation; local breeds conservation

Environment & natural resources protection : animal wastes management, alternative treatment technologies; wild hogs conservation.

Socio-economy in pig production sector : producers organisation, market relationships, evolution strategies;

Quality & food safety

Animal husbandry & sustainable practices : pig production systems, les technical & economic performances, productivity & reproduction improvement.

There are links to both an English and a French version of the site.

The 5th International Wild Boar Symposium will be held in Krakow, Poland from September 1-5. The Symposium is open for registration and the deadline to submit abstracts is July 15. By June 10, 2004, more information will be available at www.wild-boar.org.pl. For information contact Prof dr hab. Boguslaw Bobek (email: bobek@bio.ua.pt)

New Literature on Suiformes

Ecology and conservation studies

1. Altrichter, M., and G. I. Boaglio. 2004. Distribution and relative abundance of peccaries in the Argentine Chaco: associations with human factors. Biological Conservation 116:217-225.

Abstract: In the Argentine Chaco, the three species of peccaries (Artiodactyla) are likely affected by habitat destruction and hunting, yet basic information on peccary distribution and status in this region is poorly known. This study identifies human factors associated with relative abundance and distribution of each species. Estimation of relative abundance was based on interviews with local hunters, and variables potentially related to distribution and relative abundance of peccaries were estimated for 153 circular sample sites of 10 km diameter in the Argentine Chaco. Peccaries were found in sites of high forest cover, low human density, far from towns and with low density of roads. After accounting for forest cover and other variables, number of settlements was identified as the main variable negatively associated with relative abundance of the three species, which may be a result of local hunting. Density of roads was also negatively associated with presence of chacoan peccaries. Collared peccary seems to be the least susceptible to human perturbations. It was the most widely distributed and found in a wider range of conditions than the other species. Chacoan peccary was relatively rare. Because colonization and development programs are increasing in the region, areas still uninhabited should be protected, construction of roads controlled, and hunting managed.

2. Ticktin, T. 2003. Relationships between El Nino Southern Oscillation and demographic patterns in a substitute food for collared peccaries in Panama. Biotropica 35:189-197.

Abstract: Environmental fluctuations can play an important role in shaping demographic processes in plant and animal populations. On Barro Colorado Island (BCI), Panama, El Ni (n) over tildeo Southern Oscillation (ENSO) events followed by mild dry seasons have been shown to stimulate variation in community-wide fruit production. This variation has been postulated to lead to famine in frugivore and granivore populations, but few if any studies have assessed further implications for other members of the ecological community. This study examined the ways in which variation in fruit production associated with an El Ni (n) over tildeo event on BCI may influence demographic and evolutionary traits in a plant species that is only consumed by frugivores during periods of fruit scarcity. Specifically, I assessed the effects of herbivory by collared peccaries (*Tayassu tajacu*) on demographic Fates and patterns in the terrestrial bromeliad, *Aechmea magdalenae*. *Aechmea magdalenae* usually suffers little or no herbivory, and rain forest collared peccaries, which are primarily frugivorous, have not previously been reported to eat this species. Rates of survival and reproduction of 296 *A. magdalenae* rosettes in three transects of differing densities were recorded from 1997 through 1999. Mortality rates due to herbivory increased significantly from 1997 to 1999 and showed a close correspondence with enhanced and then decreased rates of community-wide fruit production associated with the 1997 ENSO. The densest portions of the *A. magdalenae* population showed lower mortality rates and higher rates of reproduction than did the less dense regions. Over the study period, *A. magdalenae* populations decreased by 45 percent. The implications of periodic herbivory by hungry frugivores are discussed with respect to population regulation, seedling dispersal, and evolution of *A. magdalenae* dense growth habit.

3. Lewison, R. L., and J. Carter. 2004. Exploring behavior of an unusual megaherbivore: a spatially explicit foraging model of the hippopotamus. Ecological Modelling 171:127-138.

Abstract: Herbivore foraging theories have been developed for and tested on herbivores across a range of sizes. Due to logistical constraints, however, little research has focused on foraging behavior of megaherbivores. Here we present a research approach that explores megaherbivore foraging behavior, and assesses the applicability of foraging theories developed on smaller herbivores to megafauma. With simulation models as reference points for the analysis of empirical data, we investigate foraging strategies of the common hippopotamus (*Hippopotamus amphibius*). Using a spatially explicit individual based foraging model, we apply traditional herbivore foraging strategies to a model hippopotamus, compare model output, and then relate these results to field data from wild hippopotami. Hippopotami appear to employ foraging strategies that respond to vegetation characteristics, such as vegetation quality, as well as spatial reference information, namely distance to a water source. Model predictions, field observations, and comparisons of the two support that hippopotami generally conform to the central place foraging construct. These analyses point to the applicability of general herbivore foraging concepts to megaherbivores, but also point to important differences between hippopotami and other herbivores. Our synergistic approach of models as reference points for empirical data highlights a useful method of behavioral analysis for hard-to-study megafauna.

4. Jenkins, R. K. B., K. Roettcher, and G. Corti. 2003. The influence of stand age on wildlife habitat use in exotic Teak tree Tectona grandis plantations. Biodiversity and Conservation 12:975-990.

Abstract: Tropical dry woodlands provide important natural resources for both humans and wildlife, but woodlands situated outside protected areas are vulnerable to over-exploitation. In the Kilombero Valley, Tanzania, miombo woodland is converted into teak plantations and small, private farms, but the impact of this habitat change on wildlife populations is poorly understood. We assessed the frequency of habitat use of large mammals in teak plantations of different age during the wet season. Vegetation structure varied significantly with age; older plantations had larger trees, a more extensive shrub layer and a well-developed leaf litter. Younger plantations had smaller trees and larger areas of short vegetation and bare ground. Track surveys revealed that older plantations were predominantly used by bush pig *Potamochoerus larvatus*, bushbuck *Tragelaphus scriptus* and duiker (*Cephalophus harveyii*, *C. natalensis* or *Sylvicarpa grimmia*), whilst the younger plantations were used by open-habitat specialists such as warthog *Phacochoerus africanus* and waterbuck *Kobus ellipsiprymnus*. Proximity to the flood plain was also found to be important and plantations nearest this area contained significantly more tracks of large grazers and bulk feeders, reflecting use by zebra *Equus burchelli*, buffalo *Syncerus caffer* and waterbuck. Areas of miombo woodland that have been converted into teak plantations provide suitable habitat for wildlife in the Kilombero Valley, but their conservation value diminishes with time. Future management should therefore aim to maintain the patchwork of miombo woodland and teak plantations in order to provide suitable habitat for a range of wildlife. Where possible, teak plantations should not be situated close to the boundary of the miombo woodland and flood plain because this habitat is an important wet season refuge for wildlife during the wet season.

5. Markov, N. I., N. D. Neifel'd, and A. A. Estaf'ev. 2004. Ecological aspects of dispersal of the wild boar, Sus scrofa L., 1758, in the northeast of European Russia. Russian Journal of Ecology 35:131-134.

No abstract available

6. Cummings, M. J. 2003. An Assessment of the Visayan Warty Pig, *Sus cebifrons* in the Imbang-Caliban Watershed, North Negros Forest Reserve, Philippines: Ecological and Social Perspectives. MSc Conservation Dissertation. University College London.

Abstract: The Visayan Warty pig, *Sus Cebifrons* is a critically endangered wild pig species that is endemic to the Negros-Panay faunal region of the Philippines. There is a void of knowledge of this species` distribution and ecology in the wild. It is threatened by negative attitudes due to its reputation as a crop pest on forest boarders. The Visayan Warty pig remains on only two of its former distribution of 6 islands due to Habitat loss and Hunting. This study aims to address the lack of knowledge on the ecology and threats to the Warty pig in the wild. Two methods were used to collect data. An ecological survey was done using 18 replicates of 150m x 150m transect grids in three different habitat types. A social study of hunting and traditional ecological knowledge was conducted in three forest edge communities. Pigs were found to utilise all three habitat types in the North Negros Forest Reserve. Hunting pressure still continues but at a smaller scale and using different techniques. Ecological knowledge among hunters is variable in extent but often rich.

Taxonomic, morphological, biogeographic, and evolutionary studies

1. Gongora J, Peltoniem OAT, Tammen I, Raadsma H, Moran C. 2003. Analyses of possible domestic Pig Contribution in two populations of Finnish farmed Wild Boar. Acta Agriculturae Scandinavica, Section A - Animal Science. 53 (4): 161-165.

Abstract: It is believed that some Finnish farmed "Wild Boars" may not originate from genuine European Wild Boar. To test this the D-loop mitochondrial sequence and nuclear glucosephosphate isomerase processed pseudogene (GPIP) and melanocortin receptor 1 (MC1R) genes were analysed in 41 Finnish farmed Wild Boar from two farms in order to determine if there was any evidence of hybrid origins. D-loop sequences clustered with European domestic pigs and northern European Wild Boars. On one farm, animals had both European and Asian/European GPIP genotypes suggestive of crossbreeding, while on the other, animals had exclusively European GPIP alleles. One animal from the first farm also had a MC1R genotype, strongly indicative of crossbreeding with European domestic pigs while the other 40 animals showed MC1R genotypes expected for genuine European Wild Boar. Joint consideration of all markers suggests that domestic pigs may have contributed to the origins of the "Wild Boar" on one of the farms.

2. Randi E.; DHuart J.-P.; Lucchini V.; Aman R. 2002. Evidence of two genetically deeply divergent species of warthog, *Phacochoerus africanus* and *P. aethiopicus* (Artiodactyla: Suiformes) in East Africa. Mammalian Biology. 67 (2): 91-96.

Abstract: Two species of warthogs (*Phacochoerus*), differing by the number of functional incisors, were described in the Holocene fossil record: the common warthog (*P. africanus*), widespread in sub-Saharan Africa, and the Cape, or desert warthog (*P. aethiopicus*), which was considered extinct since 1896, but was recently rediscovered in East Africa by morphological analyses. Mitochondrial and single-copy nuclear DNA sequences show that common and desert warthogs belong to two deeply divergent monophyletic lineages, that might have originated in the last part of the Pliocene. The finding of two genetically divergent extant species of warthogs highlights the importance of molecular methods applied to the knowledge and conservation of biodiversity in Africa, to uncover the tempo and mode of its species evolution.

3. Alves E, Ovilo C, Rodriguez MC, Silio L. 2003. Mitochondrial DNA sequence variation and phylogenetic relationships among Iberian pigs and other domestic and wild pig populations. Animal Genetics. 34(5):319-24.

Abstract: Nucleotide sequences of mitochondrial DNA (mtDNA) cytochrome B gene (1140 bp) and control region (707 bp) were used to determine the phylogenetic relationships among 51 pig samples representing ancient and current varieties of Iberian pigs (26), Spanish wild boars (seven) and other domestic pigs (18) of cosmopolitan (Duroc, Large White, Landrace, Pietrain and Meishan) and local (Spotted Black Jabugo, Basque and Mangalitza) breeds. A neighbour-joining tree constructed from pairwise distances provide evidence of the European origin of both Iberian pigs and Spanish wild boars. The introgression of Asian mtDNA haplotypes in the genetic pool of the Iberian breed seems unlikely. Four estimates of sequence divergence between European and Asian clades were calculated from the two main domains of the D-loop region and the synonymous and nonsynonymous nucleotide substitutions in the cytochrome B gene. The time since the divergence of pig ancestors was estimated at about 600,000 years before present.

4. Babicz M, Kuryl J, Walkiewicz A. 2003. Evaluation of the genetic profile of the Pulawska breed. Journal of Applied Genetics. 44(4):497-508.

Abstract: An assessment was made of the genetic variation of the Pulawska pig through the determination of polymorphism of 6 genes and 14 microsatellite sequences. The examinations covered 52 gilts included in a preservation breeding project. The identification of the alleles at microsatellite loci was performed in an ABI PRISM 310 GENETIC ANALYZER. Gene polymorphism was established by the PCR-RLFP method. On the basis of the variation of 6 genes and 14 microsatellites the mean value of the heterozygosity coefficient was estimated at 0.61, while the value of the corresponding PIC coefficient (polymorphism information content) amounted to 0.55. The probability that the genotypes of two randomly chosen individuals in a population are identical was: 6.95 × 10-3 (based on gene allele frequency) and 1.23 × 10-14 (based on microsatellite allele frequency).

5. Yang SL, Wang ZG, Liu B, Zhang GX, Zhao SH, Yu M, Fan B, Li MH, Xiong TA, Li K. 2003. Genetic variation and relationships of eighteen Chinese indigenous pig breeds.Genetics, Selection, Evolution. 35(6):657-671.

Abstract: Chinese indigenous pig breeds are recognized as an invaluable component of the world's pig genetic resources and are divided traditionally into six types. Twenty-six microsatellite markers recommended by the FAO (Food and Agriculture Organization) and ISAG (International Society of Animal Genetics) were employed to analyze the genetic diversity of 18 Chinese indigenous pig breeds with 1001 individuals representing five types, and three commercial breeds with 184 individuals. The observed heterozygosity, unbiased expected heterozygosity and the observed and effective number of alleles were used to estimate the genetic variation of each indigenous breed. The unbiased expected heterozygosity ranged between 0.700 (Mashen) and 0.876 (Guanling), which implies that there is an abundant genetic variation stored in Chinese indigenous pig breeds. Breed differentiation was shown by fixation indices (F<inf>IT</inf>, F<inf>IS</inf>, and F<inf>ST</inf>). The F<inf>ST</inf> per locus varied from 0.019 (S0090) to 0.170 (SW951), and the average F<inf>ST</inf> of all loci was 0.077, which means that most of the genetic variation was kept within breeds and only a little of the genetic variation exists between populations. The Neighbor-Joining tree was constructed based on the Nei D<inf>A</inf> (1978) distances and one large cluster with all local breeds but the Mashen breed, was obtained.

Four smaller sub-clusters were also found, which included two to four breeds each. These results, however, did not completely agree with the traditional type of classification. A Neighbor-Joining dendrogram of individuals was established from the distance of -ln(proportions of shared alleles); 92.14% of the individuals were clustered with their own breeds, which implies that this method is useful for breed demarcation. This extensive research on pig genetic diversity in China indicates that these 18 Chinese indigenous breeds may have one common ancestor, helps us to better understand the relative distinctiveness of pig genetic resources, and will assist in developing a national plan for the conservation and utilization of Chinese indigenous pig breeds.

6. Vernesi C, Crestanello B, Pecchioli E, Tartari D, Caramelli D, Hauffe H, Bertorelle G. 2003. The genetic impact of demographic decline and reintroduction in the wild boar (*Sus scrofa*): a microsatellite analysis. Molecular Ecology. 12(3):585-95.

Abstract: The reintroduction of wild boar from central Europe after World War II has contributed substantially to the range expansion of this species in Italy, where indiscriminate hunting in earlier times resulted in extreme demographic reduction. However, the genetic impact of such processes is not well-understood. In this study, 105 individuals from Italian and Hungarian wild boar populations were characterized for nine autosomal microsatellite loci. The Hungarian samples, and two central Italian samples from protected areas (parks) where reintroduction is not documented, were assumed to be representative of the genetic composition of the source and the target populations in the reintroduction process, respectively. Animals hunted in the wild in the Florence area of Tuscany (Italy) were then studied to identify the effects of reintroduction. The results we obtained can be summarized as follows: (i) none of the populations analysed shows genetic evidence of demographic decline; (ii) the three parental populations from Italy and Hungary are genetically distinct; however, the low level of divergence appears in conflict with the naming of the Italian and the European subspecies (*Sus scrofa majori* and *Sus scrofa scrofa*, respectively); in addition, the Italian groups appear to be as divergent from each other as they are from the Hungarian population; (iii) most of the individuals hunted near Florence are genetically intermediate between the parental groups, suggesting that hybridization has occurred in this area, the average introgression of Hungarian genotypes is 13%, but approximately 45% of the genetic pool of these individuals can not be directly attributed to any of the parental populations we analysed; (iv) analysis of microsatellite loci, though in a limited number, is an important tool for estimating the genetic effect of reintroduction in the wild boar, and therefore for the development of conservation and management strategies for this species.

7. Watanobe, T., N. Ishiguro, and M. Nakano. 2003. Phylogeography and population structure of the Japanese wild boar Sus scrofa leucomystax: Mitochondrial DNA variation. Zoological Science 20:1477-1489.

Abstract: Phylogeographic characteristics and population structure of Japanese wild boar (Sus scrofa leucomystax) were investigated using mitochondrial DNA (mtDNA) sequence data. Sixteen Japanese wild boar haplotypes detected from partial sequences of the mtDNA control region (574-bp) from 180 Japanese wild boar specimens from 10 local populations on Honshu, Shikoku, and Kyushu islands and 41 haplotypes from other S. scrofa were analyzed using the neighbor-joining method. The Japanese wild boars were more closely related to Northeast Asian wild boars from Mongolia than to the other Asian continental S. scrofa. The Japanese and Northeast Asian wild boars were not significantly distinguished by corrected average pairwise difference analysis. The ancestors of Japanese wild boars are suggested to have been part of the continental S. scrofa population that spread from Southeast to Northeast Asia dur-

ing the Middle to Late Pleistocene. The Japanese wild boar mtDNA haplotype cladogram shows 95% parsimoniously plausible branch connections supporting three sympatric clades. Nested clade analysis indicates that these three clades are the result of distinct historical events or gene flow. The present population of Japanese wild boars may have been formed by a few independent migrations of distinct clades from the continent with subsequent mixing on the Japanese Islands.

8. Knyazev, S. P., and S. V. Nikitin. 2004. Phylogenesis and taxonomic relationships between intraspecies forms of *Sus scrofa* (Suidae). Zoologichesky Zhurnal 83:105-118.

Abstract: The results on phylogeny and taxonomy of wild boar geographic forms and domestic pig breeds are presented. The data on the distant hybridization between wild boars and landrace pigs and typing of pig populations are compared using antigens of blood groups and serum markers. A new hypothesis of microevolution for Sus scrofa is proposed.

9. Ernst, M., J. Kuciel, and T. Urban. 2003. Analysis of genetic variation of eight candidate genes in two wild boar subspecies. Czech Journal of Animal Science 48:533-539.

Abstract: Genetic variability and diversity of two subspecies of wild boar (Sus scrofa scrofa [SSS] n = 67 and Sus scrofa attila [SSA] n = 42) were studied by the PCR-RFLP method. Eight candidate genes with two-allele polymorphisms were analysed. No polymorphism in genes encoding ryanodine (RYR1 = CRC) and oestrogen receptors (ESR) was found in either of the subspecies. In SSS, the frequencies of alleles of individual genes were as follows (frequency of one allele for each gene/locus is given): MYC protooncogene protein (MYC) A = 0.49; growth hormone (locus GH-HaeII)+ = 0.57 and (locus GH-MspI)+ 0.43; leptin (LEP) T = 0.79; heart fatty acid-binding protein (H-FABP) H = 1.00; prolactin receptor (PRLR) A 0.22 and follicle-stimulating hormone - beta polypeptide (FSHB) A = 0.40. In SSS, average heterozygosity of genotypes was 0.295. The SSA subspecies showed the following allele frequencies of individual genes: MYC A = 0.01; GH-HaeII+ = 0.65 and GH-MspI+ = 0.35; LEP T= 1.00; H-FABP H = 0.98; PRLR A = 0.33; FSHB A = 0.49. In SSA, the average heterozygosity of genotypes was 0.216. Highly significant differences in genotype frequencies between these two subspecies were found in MYC and LEP PIC values of the polymorphic loci ranged from 0.023 to 0.375 in both subspecies. Differences between both subspecies of wild boar on the one hand and compared to some breeds of domestic pigs were found in the polymorphism of genes RYR1, ESR, and MYC.

10. Dubost, G., C. Dutertre, and O. Henry. 2003. Body weight increase in the two peccary species of the genus Tayassu (Tayassuidae, Artiodactyla). Mammalia 67:55-63.

Abstract: The developmental characteristics of two congeneric species, the collared peccary Tayassu tajacu (L.) and the white-lipped peccary T pecari (Link), were studied from birth to adulthood in captive-born animals at a field station in French Guiana. Both sexes and both species show several accelerations and decelerations of the mean daily weight increase. Four maxima of weight increase coincide well with the 4 crucial stages of development: weaning, tooth eruption or replacement, and onset of sexual maturity. Following the von Bertalanffy equation, peccary females show a coefficient of catabolism k equal or superior to males, as in most artiodactyls. Consequently, as in many artiodactyls, females are initially heavier than males; then, in a complete reversal of body weights, males continue their fast growth and become progressively heavier than females. Like the European wild boar, the coefficient k is greater in peccary species than in the other artiodactyls of comparable body weight; conversely, peccaries attain their adult weight faster. The percent birth weight to maternal weight, the coefficient of catabolism k

and the time to reach adult weight place the peccaries between the suids and the ruminants. This is consistent with the features shown by their morphology, anatomy and physiology.

11. Weston, E. M. 2003. Evolution of ontogeny in the hippopotamus skull: using allometry to dissect developmental change. Biological Journal of the Linnean Society 80:625-638.

Abstract: Allometry describes the effect of size change on aspects of an organism's form and can be used to summarize the developmental history of growing parts of an animal. By comparing how allometric growth differs between species, it is possible to reveal differences in their pathways of development. The ability to compare and categorize developmental change between species is demonstrated here using morphometric methods. This involves the interspecific statistical comparison of a large number of bivariate relationships that summarize ontogenetic trajectories. These linear ontogenetic trajectories can be modified as they evolve in any of three ways: ontogenetic scaling indicative of change in the duration of growth, lateral shifts indicative of changes in prenatal development, and directional change indicative of novel modes of postnatal growth. I apply this analysis to skulls of the common hippopotamus (*Hippopotamus amphibius*) and the pygmy hippopotamus (*Hexaprotodon liberiensis*). The number of allometric changes falling into each category was statistically determined and Jolicoeur's multivariate generalization of simple allometry was used to provide an overview of cranial variation. For these skulls, directional change was not found to be statistically significant, but ontogenetic scaling and lateral shifts were both common. This indicates that conserved patterns of growth covariance (ontogenetic scaling) can be separated from novel or derived patterns (directional change and/or lateral shifts). This study demonstrates that *He. liberiensis* is not simply an ontogenetically scaled version of its larger relative. The evolutionary implications of allometric growth variation are discussed in the light of these findings and those of other studies.

12. Feldhamer, G. A., and B. E. McCann. 2004. Dental anomalies in wild and domestic Sus scrofa in Illinois. Acta Theriologica 49:139-143.

Abstract: The cleaned skulls of 39 wild and 30 domestic pigs from southern Illinois (USA) were assessed for dental anomalies including polydonty, oligodonty, misalignment, and rotation. Dental anomalies occurred in 16 wild and 15 domestic pigs. Oligodonty (either bilateral or unilateral) was the most common anomaly, occurring in 9 wild (23.1% of the sample) and 15 (50%) domestic pigs. In 22 of the 24 individuals exhibiting oligodonty, this anomaly involved the lower first premolar (P-1). Given the placement of P-1, oligodonty may reflect a trend toward reduction of the dental arcade from the primitive eutherian number. Domesticated species are reported to have more anomalies than wild counterparts because of inbreeding. We found no difference in the number of dental anomalies between domestic and wild pigs.

Veterinary studies

1. Ehlers, B., and S. Lowden. 2004. Novel herpesviruses of Suidae: indicators for a second genogroup of artiodactyl gammaherpesviruses. Journal of General Virology 85:857-862.

Abstract: Five novel herpesviruses were identified in suid species from Africa (common warthog, *Phacochoerus africanus*) and South-East Asia (bearded pig, *Sus barbatus*; babirusa, *Babyrousa babyrussa*) by detection and analysis of their DNA polymerase genes. Three of the novel species, P. africanus cytomegalovirus 1, P. africanus lymphotropic herpesvirus 1 (PafrLHV-1) and S. barbatus lymphotropic herpesvirus 1 (SbarLHV-1), were closely related to known beta- (porcine cytomegalovirus)

and gammaherpesviruses [porcine lymphotropic herpesvirus (PLHV) 1 and 3] of domestic pigs. In contrast, two novel species, *S. barbatus rhadinovirus* 1 (SbarRHV-1) and *Babyrousa babyrussa rhadinovirus* 1 (BbabRHV-1), were more closely related to a ruminant gammaherpesvirus, bovine herpesvirus 4 (BoHV-4), than to the porcine gammaherpesviruses PLHV-1, -2, -3, PafrLHV-1 and SbarLHV-1. SbarRHV-1, BbabRHV-1 and BoHV-4 were therefore tentatively assigned to a novel genogroup of artiodactyl gammaherpesviruses. This latter genogroup may also contain an as yet undiscovered gammaherpesvirus of domestic pigs, thereby adding a concern to their use in xenotransplantation.

2. Mayor, P., F. Jori, and M. Lopez-Bejar. 2004. Anatomicohistological characteristics of the tubular genital organs of the female, collared peccary (Tayassu tajacu) from north-eastern Amazon. Anatomia, Histologia, Embryologia: Veterinary Medicine Series C 33:65-74.

Abstract: The present study examines anatomical and histological characteristics of tubular genital organs and its relationships with the reproductive state of 24 wild adult collared peccary (Tayassu tajacu) females. The tunica mucosa of the uterine tube presents a pseudostratified, intermittently ciliated columnar epithelium. The epithelial secretory cells of pregnant females and females in the luteal phase of the oestrous cycle became taller than the ciliated cells and showed abundant apical secretory blebs, whereas secretory cells of females in the follicular phase showed abundant mucous secretory activity (periodic acid-Schiff positive cells). The uterus is composed of two narrow and convoluted uterine horns, separated by the velum uteri, a small uterine body and a long and muscular cervix. The endometrial lining of both uterine horns and body is a monostratified, columnar ciliated epithelium. Pregnant females and females in luteal phase showed a more developed hyperplasia of the endometrial simple tubular glands than females in the follicular phase. The cervix presents interdigitated rows of mucosal prominences that project into the lumen, structures similar to pulvini cervicali, occluding the cervical canal. In pregnant females, the endocervical canal was filled by a viscous cervical secretion. Females in follicular phase presented a thicker vaginal epithelium than pregnant females and females in luteal phase. The present study suggests that the collared peccary female showed different histological features of the uterine tubes, uterus and vagina in accordance with the reproductive state of the females.

3. Ferroglio, E., Wambwa, E., Castiello, M., Trisciuoglio, A., Prouteau, A., Pradere, E., Ndungu, S., de Meneghi, D., and de Meneghi, D. 2003. Antibodies to *Neospora caninum* in wild animals from Kenya, East Africa. Veterinary-Parasitology 118(1-2): 43-49

Abstract: The prevalence of antibodies to *Neospora caninum* was examined in six wild Artiodactyla species, and in five wild Carnivora species from Kenya (1998-2001). Blood sera (104 wild ungulates from Marula Estates (MEs), and 31 wild carnivores from Masai-Mara reserve and from other wildlife areas in northern and Southern Kenya), were screened using a Neospora agglutination test (NAT), with a two-fold dilution (1:40-1:320 titres). Presence of NAT antibodies to *N. caninun* is reported here for the first time in zebra (*Equus burchelli*), eland (Taurotragus oryx), African buffalo (*Syncerus caffer*), Thompson gazelle (*Gazella thompsoni*), impala (*Aepyceros melampus*), warthog (*Phacochoerus aethiopicus*), spotted hyena (*Crocuta crocuta*) and in free-ranging cheetah (*Acinonyx jubatus*). At 1:80 dilution, prevalence was 61.5% in eland, 58.5% in zebra, 19.2% in Thompson gazelle, 33.3% in warthog, 50% in African buffalo, 30% in lion (*Panthera leo*), 20% in cheetah, and 33.3% in spotted hyena. Antibodies up to 1:320 titre were detected in eland (38.4%), zebra (19.5%), Thompson gazelle (3.8%) and lion (5%). Amongst herbivores, sero-prevalence was significantly ($P < 0.05$) higher, at all dilutions, in "grazer/digger" species (e.g. eland and zebra) than in non-"grazer/digger" species (e.g. impala and Thompson gazelle). No antibodies to *N. caninum* were found in two leopards (*Panthera pardus*) and one serval

(*Felis serval*). Our results indicates a steady presence of *N. caninum* in wild mammals from Kenya. The hypothesis of a sylvatic cycle of *N. caninum* could be suggested, but more data are needed to verify the hypothesis, as to evaluate the role of *N. caninum* infection on the dynamics of wild animals population in the study area.

4. Morgan, J.A.T., DeJong, R.J., Kazibwe, F., Mkoji, G.M., and Loker, E.S. 2003. A newly-identified lineage of *Schistosoma*. International-Journal-for-Parasitology 33(9); 977-985.

Abstract: Because of their role in causing schistosomiasis, flukes of the genus Schistosoma are the best known of all digeneans. The genus has traditionally been divided into four familiar species groups. Here we report on three poorly known species of *Schistosoma*, one of which, *Schistosoma hippopotami*, is known from the hippopotamus, one of which is provisionally identified as *Schistosoma edwardiense*, another hippo parasite, and a third that has not previously been described. All were collected from freshwater snails obtained from Lake Edward, western Uganda, the type locality for both known hippo schistosomes. The three different kinds of schistosome cercariae differ from one another in size, and all are readily differentiated by their long tail stems from the cercariae of human-infecting species. Furthermore, each was recovered from a different genus of snail host, *Biomphalaria sudanica*, Bulinus *truncatus* or *Ceratophallus natalensis*. Molecular analysis, based on 8350 bases of combined nuclear and mitochondrial DNA, groups these three long tail-stem cercariae into a well supported clade that does not associate with any of the recognised species groups. The placement of this clade, basal to all African species plus several Asian species, suggests that there has been an ancient association between *Schistosoma* and hippos. This new African *Schistosoma* clade advocates the need for further modification of the traditional species group-based classification. Two of the four species groups are paraphyletic. It also suggests that *Schistosoma* has been remarkably plastic with respect to adapting to snail hosts -- three distantly related genera of planorbid snails have been exploited by worms within a single clade. Finally, it adds a new layer of complexity to deciphering the origins of *Schistosoma*, often considered to be African but recently challenged as being Asian. In the late Cenozoic the distribution of hippo species straddled both Africa and Asia and they may have provided a means for the introduction of blood flukes to Africa.

5. Sipos, W., Fischer, L., Schindler, M. and Schmoll, F. 2003. Genotyping of *Clostridium perfringens* isolated from domestic and exotic ruminants and swine. Journal-of-Veterinary-Medicine.-Series-B 50 (7): 360-362.

Abstract: *Clostridium perfringens* types A, B, C, D and E are known to cause severe enteritis/ enterotoxaemia and diseases (especially caused by type A) belonging to the gas oedema complex in many species. Samples from the small intestine as well as faeces of domestic and exotic animals suffering from enterotoxaemic signs or having died within days after first occurrence of toxaemia were submitted for typing *C. perfringens* toxovars by multiplex PCR. The following species have been investigated: domestic sheep (*Ovis ammon*; n=10), domestic goat (*Capra aegagrus hircus*; n=26), Japanese serow (*Capricornis sumatraensis*; n=4), lechwe waterbuck (*Hydrotragus leche*; n=1), blackbuck (*Antilope cervicapra*; n=1), European reindeer (*Rangifer tarandus tarandus*; n=4), domestic swine (*Sus scrofa*; n=52), and collared peccary (*Tayassu albirostris*; n=1). Interestingly, the predominant *C. perfringens toxovar* in domestic sheep was type A. This toxovar could also be diagnosed in all reindeer, in three Japanese serows, one lechwe waterbuck and most pigs (n=47), the majority of those being at suckling age. Type D was the most prevalent toxovar (n=18) in domestic goats, but also types A and E could be

identified as pathogens in this species. Type C could only be found in domestic swine (n=5) and in one case of clostridiosis in a Japanese serow. Two cases of enterotoxaemia in goats, one case in reindeer, and a single case in blackbuck and collared peccary were caused by *C. perfringens* type E. Genotyping of *C. perfringens* is recommended before starting vaccination programmes as it could be shown, that the importance of specific toxovars has been underestimated in specific species and/or age groups.

6. Carvalho, A.F., Lima, M.C., Santos, T.C., Bonatelli, M., Miglino, M.A., Samoto, V.Y., Oliveira, M. F., Ambrosio, C.E., Pereira, F.T.V., and Martins, J.F.P. 2003. Microscopical analysis of the ovary of collared peccary in phase gestacional. XV Congresso Brasileiro de Repoducao Animal, Porto Seguro, Bahia, Brazil, 11-15 August 2003. Revista-Brasileira-de-Reproducao-Animal. 27(2): 278-279.

No abstract available

7. Paula, V.V., Moura, C.E.B., Filgueira, K.D., Carvalho, R.C., Costa, W.P., Albuquerque, J.F.G., Oliveira, M.F., Pereira, H.M., and Batista, J.S. 2003. Morphology of the female genital organs of the collared peccary created in captivity in the semi-arid northeasterner. XV Congresso Brasileiro de Repoducao Animal, Porto Seguro, Bahia, Brazil, 11-15 August 2003. Revista-Brasileira-de-Reproducao-Animal. 2003, 27: 2, 276-277.

No abstract available

Animal husbandry

Hide, R. 2003. Pig husbandry in New Guinea. A literature review and bibliography. Australian Council of International Agricultural Research (ACIAR).

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The newsletter of the IUCN/SSC Pigs, Peccaries and Hippos Specialist Group (previously Asian Wild Pig News)

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Pigs, peccaries and hippopotamuses are non-ruminant ungulates belonging to the Suborder Suiformes of the Order Artiodactyla (the even-toed ungulates).

Within the Suborder Suiformes, pigs belong to the Family Suidae, peccaries to the Family Dicotylidae and hippopotamuses to the Family Hippopotamidae.